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THE FERTILIZATION OF CITRUS

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The fertilizers that are applied to the citrus groves of California differ widely. Many growers use one or more of the well known brands of commercial fertilizer; others apply large amounts of dried blood, tankage, bone meal, or ammonium sulfate; while still others rely mainly on animal manures, bean straw, and covercrops. Frequently, fertilizers of widely different composition are applied to adjacent orchards of practically the same age, and on the same type of soil. Certain fertilizer materials are now extremely difficult to obtain, and practically all of them that are of special importance to California orchardists have markedly advanced in price during the past three years.

In the use of fertilizers, California growers were formerly compelled to rely mainly on the experience of humid sections. More recently, however, various investigations have been made on this subject in California, the results of which supply information of special interest at the present time. In this circular, it is intended to point out the more important lessons taught by these investigations. It should be recognized, however, that a wide range of soil conditions are met with in different citrus orchards, and that the fertilizer needs vary considerably. Consequently, it is not possible at the present time to make definite recommendations that will apply with equal force to every citrus orchard. It is hoped, however, that the individual citrus grower may be able to apply the suggestions offered below in such way as will enable him to better meet the present fertilizer situation, and at the same time supply the fertilizer needs of his soil.

ORGANIC MATTER

The most important consideration in the fertilization of citrus in California relates to the organic matter of the soil. The virgin soils

are commonly low in organic matter and the tendency is ever toward the loss of this constituent. The forces which bring about decomposition of soil organic matter are stimulated by the more favorable conditions which ensue as a result of cultivation and irrigation; the temperature and moisture conditions are suitable for rapid decomposition throughout the main part of the year. Consequently, it is necessary to put forth special effort, if the organic matter be maintained.

Suitable physical conditions in soils are of great importance, without which no amount of fertilizer or other soil treatment can be expected to produce maximum effects. But, the maintenance of suitable physical conditions in a soil is more dependent on the presence of decaying organic matter than on any other factor. Likewise favorable chemical and active biological conditions in soils are vitally dependent on the presence of organic matter. In fact, organic matter is the life of a soil.

As a means of supplying organic matter, leguminous covercrops are recommended. It is well known that legumes have the power of fixing nitrogen from the air and thus adding it to the soil, but it is doubtful whether the value of a covercrop can be adequately estimated by its nitrogen content. The effects of decaying organic matter on the soil itself are probably of as much importance as the actual nitrogen added from the air. Leguminous covercrops undergo rapid decomposition, leaving the soil in a physical and chemical condition that is better suited to plant life. In order to avoid bad soil conditions that may otherwise arise, it is recommended that, wherever possible, the covercrop be incorporated with the soil not later than the middle of March.

A second important means of replenishing the organic supply of soils is by the use of manure, and almost every orchardist, whether he be a citrus, walnut, or deciduous fruit grower, should put forth increased effort to enlarge and conserve his supply of manure.

In general the greatest value to the soil will result from plowing down the manure as soon as possible after it is applied, but no hard and fast rules can be laid down regarding the time of application or the amount to be applied. As a general rule, better soil conditions result from making the application early than late in the season, and the amount available together with its cost will rarely permit the grower to use an excess. Ten cubic feet per tree may be considered to be a reasonable application.

Manures differ widely both in composition and in their effect on soils. The rates of decomposition likewise differ widely. Generally speaking, the more straw, sawdust, shavings, etc., a manure contains,

the more slowly it will undergo decomposition, and, just as in the case of covercrops, manures cannot be adequately valued by their plant food content. The nitrogen content of manure gives to it special value for California soils, but too much stress should not be placed on the analysis of manures, for it is beyond doubt that the effects produced by this material are often not proportionate to the plant food content. The soils need to be enlivened with decaying organic matter, and manure is a valuable material for this purpose.

Another important source of organic matter is found in bean straw and alfalfa hay, but in view of the value and need of these materials as stock feed at the present time, the citrus growers are advised to make use of winter covercrops and manures instead. However, bean straw and alfalfa hay are valuable materials for use on citrus soils. Their high nitrogen content makes it possible to supply a liberal amount of this element along with the organic matter, and the fact that these materials undergo rapid decomposition, insures rapid nitrification and therefore prompt availability.

NITROGEN

Among the common elements of fertilizers, nitrogen is by far the most important for the citrus soils of California. Most of these soils are notably deficient in nitrogen; the citrus tree requires relatively large amounts of nitrogen and the loss of nitrogen through leaching is relatively great. All parts of the citrus tree, including the wood, leaves, and fruit, contain considerably more nitrogen than any other fertilizer element and experiments in different localities show that marked benefits result from the application of nitrogenous fertilizers. In fact, all of the various lines of investigation and practical experience agree in giving special importance to the use of nitrogenous fertilizers on the citrus soils of California.

At the present time, it appears that any one of a considerable range of nitrogenous materials may be used with fair assurance of success. Dried blood, tankage, whale meat, fish scraps, cotton seed meal, bone meal, the nitrogen of processed fertilizers, ammonium sulfate, etc., may be used with assurance that the nitrogen will readily become available. Calcium nitrate may also be expected to give good results. In choosing between these materials, it should be borne in mind that their nitrogen content varies greatly, and that, as a general rule, their value as fertilizers for citrus in California is proportionate to the nitrogen content.

The amount of nitrogen that may profitably be applied will depend on at least three factors: First, the amount of growth made by the leguminous covercrop; second, the amount of manure or other organic

nitrogenous material that is applied; and third, the age of the trees and condition of the soil. In general, the larger the trees and the heavier the crop, the more nitrogen is required, but on the other hand, the better the growth of the covercrop and the heavier the application of manure, the less nitrogenous fertilizer will be needed. The grower can best be guided in this matter by the experience of the best growers in his community, together with his own local conditions.

The nitrogen of nitrate of soda is also readily available, and in other parts of the world, this material is generally considered to be one of the most valuable sources of nitrogen. It has even been used successfully in some localities in California. Nevertheless, the citrus growers of California are cautioned against its use here for the reason that in many cases the continued use of nitrate of soda has resulted in an increased tendency toward mottled leaf. In view of this fact, and since other sources of nitrogen are available, caution is advised in the use of this material on citrus soils.

PHOSPHORIC ACID

The second most important fertilizer constituent for the citrus soils of California is phosphoric acid, but the need is much less urgent than for nitrogen. The requirements of the citrus tree for phosphoric acid are notable, however, and many of the soils contain comparatively small amounts of it, consequently it will probably pay to apply limited amounts of phosphoric acid. Superphosphate, bone meal, or tankage are suitable sources of this constituent. When used in intimate contact with decaying organic matter, rock phosphate may also be applied as a source of phosphoric acid.

POTASH

All the information at hand points to the conclusion that potash can be eliminated, for the present at least, from the citrus fertilizers of California without seriously affecting the growth of the trees or fruit. Many of the soils have been derived from granite and, generally speaking, the soils throughout the citrus region are well supplied with potash. In addition, the effects resulting from the application of potash in a number of localities have been negligible. Consequently, it is fairly safe to conclude that the potash already present in most of the soils will become available sufficiently fast to meet the requirements of citrus trees for a number of years at least, without any artificial application. This is especially true where the soil is kept in good condition through the use of covercrops or manure. In view of these facts, and since the amount of potash available for use is quite limited, the use of potash as a fertilizer is not recommended at the present time.